

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
5 July 2007 (05.07.2007)

PCT

(10) International Publication Number  
**WO 2007/076078 A2**

- (51) International Patent Classification:  
*B65G 67/00* (2006.01)
- (21) International Application Number:  
PCT/US2006/049154
- (22) International Filing Date:  
21 December 2006 (21.12.2006)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:  
60/752,787 22 December 2005 (22.12.2005) US
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- (81) Designated States (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM,

AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

**Declarations under Rule 4.17:**

- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
- *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*
- *of inventorship (Rule 4.17(iv))*

**Published:**

- *without international search report and to be republished upon receipt of that report*

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

WO 2007/076078 A2

(54) Title: EXPANDABLE, INFLATABLE PACKER

(57) Abstract: A method and an apparatus for forming a seal in a borehole.

**EXPANDABLE, INFLATABLE PACKER****CROSS REFERENCE TO RELATED APPLICATIONS**

This application claims the benefit of the filing date of U.S. provisional patent application serial number 60/752,787, attorney docket number 25791.339, filed on December 22, 2005, the disclosure of which is incorporated herein by reference.

This application is related to the following co-pending applications: (1) U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (2) U.S. patent application serial no. 09/510,913, attorney docket no. 25791.7.02, filed on 2/23/2000, which claims priority from provisional application 60/121,702, filed on 2/25/99, (3) U.S. patent application serial no. 09/502,350, attorney docket no. 25791.8.02, filed on 2/10/2000, which claims priority from provisional application 60/119,611, filed on 2/11/99, (4) U.S. patent no. 6,328,113, which was filed as U.S. Patent Application serial number 09/440,338, attorney docket number 25791.9.02, filed on 11/15/99, which claims priority from provisional application 60/108,558, filed on 11/16/98, (5) U.S. patent application serial no. 10/169,434, attorney docket no. 25791.10.04, filed on 7/1/02, which claims priority from provisional application 60/183,546, filed on 2/18/00, (6) U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, (now U.S. Patent 6,640,903 which issued 11/4/2003), which claims priority from provisional application 60/124,042, filed on 3/11/99, (7) U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (8) U.S. patent number 6,575,240, which was filed as patent application serial no. 09/511,941, attorney docket no. 25791.16.02, filed on 2/24/2000, which claims priority from provisional application 60/121,907, filed on 2/26/99, (9) U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (10) U.S. patent application serial no. 09/981,916, attorney docket no. 25791.18, filed on 10/18/01 as a continuation-in-part application of U.S. patent no. 6,328,113, which was filed as U.S. Patent Application serial number 09/440,338, attorney docket number 25791.9.02, filed on 11/15/99, which claims priority from provisional application 60/108,558, filed on 11/16/98, (11) U.S. patent number 6,604,763, which was filed as application serial no. 09/559,122, attorney docket no. 25791.23.02, filed on 4/26/2000, which claims priority from provisional application 60/131,106, filed on 4/26/99, (12) U.S. patent application serial no. 10/030,593, attorney docket no. 25791.25.08, filed on 1/8/02, which claims priority from provisional application 60/146,203, filed on 7/29/99, (13) U.S. provisional patent application serial no. 60/143,039, attorney docket no. 25791.26, filed on 7/9/99, (14) U.S. patent application serial no. 10/111,982, attorney docket no. 25791.27.08, filed on 4/30/02, which claims priority from provisional patent application serial no. 60/162,671, attorney docket no. 25791.27, filed on 11/1/1999, (15) U.S. provisional patent application serial no. 60/154,047, attorney

docket no. 25791.29, filed on 9/16/1999, (16) U.S. provisional patent application serial no. 60/438,828, attorney docket no. 25791.31, filed on 1/9/03, (17) U.S. patent number 6,564,875, which was filed as application serial no. 09/679,907, attorney docket no. 25791.34.02, on 10/5/00, which claims priority from provisional patent application serial no. 60/159,082, attorney docket no. 25791.34, filed on 10/12/1999, (18) U.S. patent application serial no. 10/089,419, filed on 3/27/02, attorney docket no. 25791.36.03, which claims priority from provisional patent application serial no. 60/159,039, attorney docket no. 25791.36, filed on 10/12/1999, (19) U.S. patent application serial no. 09/679,906, filed on 10/5/00, attorney docket no. 25791.37.02, which claims priority from provisional patent application serial no. 60/159,033, attorney docket no. 25791.37, filed on 10/12/1999, (20) U.S. patent application serial no. 10/303,992, filed on 11/22/02, attorney docket no. 25791.38.07, which claims priority from provisional patent application serial no. 60/212,359, attorney docket no. 25791.38, filed on 6/19/2000, (21) U.S. provisional patent application serial no. 60/165,228, attorney docket no. 25791.39, filed on 11/12/1999, (22) U.S. provisional patent application serial no. 60/455,051, attorney docket no. 25791.40, filed on 3/14/03, (23) PCT application US02/2477, filed on 6/26/02, attorney docket no. 25791.44.02, which claims priority from U.S. provisional patent application serial no. 60/303,711, attorney docket no. 25791.44, filed on 7/6/01, (24) U.S. patent application serial no. 10/311,412, filed on 12/12/02, attorney docket no. 25791.45.07, which claims priority from provisional patent application serial no. 60/221,443, attorney docket no. 25791.45, filed on 7/28/2000, (25) U.S. patent application serial no. 10/, filed on 12/18/02, attorney docket no. 25791.46.07, which claims priority from provisional patent application serial no. 60/221,645, attorney docket no. 25791.46, filed on 7/28/2000, (26) U.S. patent application serial no. 10/322,947, filed on 1/22/03, attorney docket no. 25791.47.03, which claims priority from provisional patent application serial no. 60/233,638, attorney docket no. 25791.47, filed on 9/18/2000, (27) U.S. patent application serial no. 10/406,648, filed on 3/31/03, attorney docket no. 25791.48.06, which claims priority from provisional patent application serial no. 60/237,334, attorney docket no. 25791.48, filed on 10/2/2000, (28) PCT application US02/04353, filed on 2/14/02, attorney docket no. 25791.50.02, which claims priority from U.S. provisional patent application serial no. 60/270,007, attorney docket no. 25791.50, filed on 2/20/2001, (29) U.S. patent application serial no. 10/465,835, filed on 6/13/03, attorney docket no. 25791.51.06, which claims priority from provisional patent application serial no. 60/262,434, attorney docket no. 25791.51, filed on 1/17/2001, (30) U.S. patent application serial no. 10/465,831, filed on 6/13/03, attorney docket no. 25791.52.06, which claims priority from U.S. provisional patent application serial no. 60/259,486, attorney docket no. 25791.52, filed on 1/3/2001, (31) U.S. provisional patent application serial no. 60/452,303, filed on 3/5/03, attorney docket no. 25791.53, (32) U.S. patent number 6,470,966, which was filed as patent application serial number 09/850,093, filed on 5/7/01, attorney docket no. 25791.55, as a divisional application of U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293,

filed on 12/7/98, (33) U.S. patent number 6,561,227, which was filed as patent application serial number 09/852,026, filed on 5/9/01, attorney docket no. 25791.56, as a divisional application of U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (34) U.S. patent application serial number 09/852,027, filed on 5/9/01, attorney docket no. 25791.57, as a divisional application of U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (35) PCT Application US02/25608, attorney docket no. 25791.58.02, filed on 8/13/02, which claims priority from provisional application 60/318,021, filed on 9/7/01, attorney docket no. 25791.58, (36) PCT Application US02/24399, attorney docket no. 25791.59.02, filed on 8/1/02, which claims priority from U.S. provisional patent application serial no. 60/313,453, attorney docket no. 25791.59, filed on 8/20/2001, (37) PCT Application US02/29856, attorney docket no. 25791.60.02, filed on 9/19/02, which claims priority from U.S. provisional patent application serial no. 60/326,886, attorney docket no. 25791.60, filed on 10/3/2001, (38) PCT Application US02/20256, attorney docket no. 25791.61.02, filed on 6/26/02, which claims priority from U.S. provisional patent application serial no. 60/303,740, attorney docket no. 25791.61, filed on 7/6/2001, (39) U.S. patent application serial no. 09/962,469, filed on 9/25/01, attorney docket no. 25791.62, which is a divisional of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, (now U.S. Patent 6,640,903 which issued 11/4/2003), which claims priority from provisional application 60/124,042, filed on 3/11/99, (40) U.S. patent application serial no. 09/962,470, filed on 9/25/01, attorney docket no. 25791.63, which is a divisional of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, (now U.S. Patent 6,640,903 which issued 11/4/2003), which claims priority from provisional application 60/124,042, filed on 3/11/99, (41) U.S. patent application serial no. 09/962,471, filed on 9/25/01, attorney docket no. 25791.64, which is a divisional of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, (now U.S. Patent 6,640,903 which issued 11/4/2003), which claims priority from provisional application 60/124,042, filed on 3/11/99, (42) U.S. patent application serial no. 09/962,467, filed on 9/25/01, attorney docket no. 25791.65, which is a divisional of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, (now U.S. Patent 6,640,903 which issued 11/4/2003), which claims priority from provisional application 60/124,042, filed on 3/11/99, (43) U.S. patent application serial no. 09/962,468, filed on 9/25/01, attorney docket no. 25791.66, which is a divisional of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, (now U.S. Patent 6,640,903 which issued 11/4/2003), which claims priority from provisional application 60/124,042, filed on 3/11/99, (44) PCT application US 02/25727, filed on 8/14/02, attorney docket no. 25791.67.03, which claims priority from U.S. provisional patent application serial no. 60/317,985, attorney docket no. 25791.67, filed on

9/6/2001, and U.S. provisional patent application serial no. 60/318,386, attorney docket no. 25791.67.02, filed on 9/10/2001, (45) PCT application US 02/39425, filed on 12/10/02, attorney docket no. 25791.68.02, which claims priority from U.S. provisional patent application serial no. 60/343,674, attorney docket no. 25791.68, filed on 12/27/2001, (46) U.S. utility patent application serial no. 09/969,922, attorney docket no. 25791.69, filed on 10/3/2001, (now U.S. Patent 6,634,431 which issued 10/21/2003), which is a continuation-in-part application of U.S. patent no. 6,328,113, which was filed as U.S. Patent Application serial number 09/440,338, attorney docket number 25791.9.02, filed on 11/15/99, which claims priority from provisional application 60/108,558, filed on 11/16/98, (47) U.S. utility patent application serial no. 10/516,467, attorney docket no. 25791.70, filed on 12/10/01, which is a continuation application of U.S. utility patent application serial no. 09/969,922, attorney docket no. 25791.69, filed on 10/3/2001, (now U.S. Patent 6,634,431 which issued 10/21/2003), which is a continuation-in-part application of U.S. patent no. 6,328,113, which was filed as U.S. Patent Application serial number 09/440,338, attorney docket number 25791.9.02, filed on 11/15/99, which claims priority from provisional application 60/108,558, filed on 11/16/98, (48) PCT application US 03/00609, filed on 1/9/03, attorney docket no. 25791.71.02, which claims priority from U.S. provisional patent application serial no. 60/357,372, attorney docket no. 25791.71, filed on 2/15/02, (49) U.S. patent application serial no. 10/074,703, attorney docket no. 25791.74, filed on 2/12/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (50) U.S. patent application serial no. 10/074,244, attorney docket no. 25791.75, filed on 2/12/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (51) U.S. patent application serial no. 10/076,660, attorney docket no. 25791.76, filed on 2/15/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (52) U.S. patent application serial no. 10/076,661, attorney docket no. 25791.77, filed on 2/15/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (53) U.S. patent application serial no. 10/076,659, attorney docket no. 25791.78, filed on 2/15/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (54) U.S. patent application serial no. 10/078,928, attorney docket no. 25791.79, filed on 2/20/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed

on 2/26/99, (55) U.S. patent application serial no. 10/078,922, attorney docket no. 25791.80, filed on 2/20/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (56) U.S. patent application serial no. 10/078,921, attorney docket no. 25791.81, filed on 2/20/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (57) U.S. patent application serial no. 10/261,928, attorney docket no. 25791.82, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (58) U.S. patent application serial no. 10/079,276, attorney docket no. 25791.83, filed on 2/20/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (59) U.S. patent application serial no. 10/262,009, attorney docket no. 25791.84, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (60) U.S. patent application serial no. 10/092,481, attorney docket no. 25791.85, filed on 3/7/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (61) U.S. patent application serial no. 10/261,926, attorney docket no. 25791.86, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (62) PCT application US 02/36157, filed on 11/12/02, attorney docket no. 25791.87.02, which claims priority from U.S. provisional patent application serial no. 60/338,996, attorney docket no. 25791.87, filed on 11/12/01, (63) PCT application US 02/36267, filed on 11/12/02, attorney docket no. 25791.88.02, which claims priority from U.S. provisional patent application serial no. 60/339,013, attorney docket no. 25791.88, filed on 11/12/01, (64) PCT application US 03/11765, filed on 4/16/03, attorney docket no. 25791.89.02, which claims priority from U.S. provisional patent application serial no. 60/383,917, attorney docket no. 25791.89, filed on 5/29/02, (65) PCT application US 03/15020, filed on 5/12/03, attorney docket no. 25791.90.02, which claims priority from U.S. provisional patent application serial no. 60/391,703, attorney docket no. 25791.90, filed on 6/26/02, (66) PCT application US 02/39418, filed on 12/10/02, attorney docket no. 25791.92.02, which claims priority from U.S. provisional patent application serial no. 60/346,309, attorney docket no. 25791.92, filed on 1/7/02, (67) PCT application US 03/06544, filed on 3/4/03, attorney docket no. 25791.93.02, which claims priority from U.S. provisional patent

application serial no. 60/372,048, attorney docket no. 25791.93, filed on 4/12/02, (68) U.S. patent application serial no. 10/331,718, attorney docket no. 25791.94, filed on 12/30/02, which is a divisional U.S. patent application serial no. 09/679,906, filed on 10/5/00, attorney docket no. 25791.37.02, which claims priority from provisional patent application serial no. 60/159,033, attorney docket no. 25791.37, filed on 10/12/1999, (69) PCT application US 03/04837, filed on 2/29/03, attorney docket no. 25791.95.02, which claims priority from U.S. provisional patent application serial no. 60/363,829, attorney docket no. 25791.95, filed on 3/13/02, (70) U.S. patent application serial no. 10/261,927, attorney docket no. 25791.97, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (71) U.S. patent application serial no. 10/262,008, attorney docket no. 25791.98, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (72) U.S. patent application serial no. 10/261,925, attorney docket no. 25791.99, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (73) U.S. patent application serial no. 10/199,524, attorney docket no. 25791.100, filed on 7/19/02, which is a continuation of U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (74) PCT application US 03/10144, filed on 3/28/03, attorney docket no. 25791.101.02, which claims priority from U.S. provisional patent application serial no. 60/372,632, attorney docket no. 25791.101, filed on 4/15/02, (75) U.S. provisional patent application serial no. 60/412,542, attorney docket no. 25791.102, filed on 9/20/02, (76) PCT application US 03/14153, filed on 5/6/03, attorney docket no. 25791.104.02, which claims priority from U.S. provisional patent application serial no. 60/380,147, attorney docket no. 25791.104, filed on 5/6/02, (77) PCT application US 03/19993, filed on 6/24/03, attorney docket no. 25791.106.02, which claims priority from U.S. provisional patent application serial no. 60/397,284, attorney docket no. 25791.106, filed on 7/19/02, (78) PCT application US 03/13787, filed on 5/5/03, attorney docket no. 25791.107.02, which claims priority from U.S. provisional patent application serial no. 60/387,486, attorney docket no. 25791.107, filed on 6/10/02, (79) PCT application US 03/18530, filed on 6/11/03, attorney docket no. 25791.108.02, which claims priority from U.S. provisional patent application serial no. 60/387,961, attorney docket no. 25791.108, filed on 6/12/02, (80) PCT application US 03/20694, filed on 7/1/03, attorney docket no. 25791.110.02, which claims priority from U.S. provisional patent application serial no. 60/398,061, attorney docket no. 25791.110, filed on 7/24/02, (81) PCT application US 03/20870, filed on 7/2/03, attorney docket no. 25791.111.02, which claims priority from U.S. provisional patent application serial no. 60/399,240,

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## **BACKGROUND OF THE INVENTION**

The present disclosure relates to drilling a borehole in a subterranean formation, and more particularly to an apparatus and a method for making and using the apparatus, to form an annular seal between casing and tubing or between tubing and the borehole.

Conventionally, an annular seal is formed by a packer, a device that can be run into a wellbore with a smaller initial outside diameter that then expands externally to seal the wellbore. The two most common forms are the production or test packer and the inflatable packer. The expansion of the production packer may be accomplished by squeezing annular elastomeric elements between two plates, forcing the sides to bulge outward. The expansion of the inflatable packer is accomplished by pumping a fluid into a bladder using surface pump pressure. In either type of packer, valves or moving parts are required to expand and set the packer.

The present invention is directed to overcoming one or more of the limitations of the existing procedures for forming a seal in a wellbore.

## **BRIEF DESCRIPTION OF THE DRAWINGS**

Figure 1 is an illustration of a conventional method for drilling a borehole in a subterranean formation.

Figure 2 is an illustration of a device for coupling an expandable tubular member to an existing tubular member.

Figure 3 is an illustration of a hardenable fluidic sealing material being pumped down the device of Figure 2.

Figure 4 is an illustration of the expansion of an expandable tubular member using the expansion device of Figure 2.

Figure 5 is an illustration of the completion of the radial expansion and plastic deformation of an expandable tubular member.

Figure 6 is a longitudinal cross sectional view of an exemplary embodiment of an expandable inflatable packer.

Figure 7 is an illustration of the initial expansion of the expandable inflatable packer of Figure 6 using a pressure source.

Figure 8 is an illustration of the further expansion of the expandable, inflatable packer of Figure 6 using a pressure source.

Figure 9 is an illustration of the completion of the expansion of the expandable inflatable packer of Figure 6 using a pressure source.

Figure 10 is a longitudinal cross sectional view of the expandable inflatable packer of Figure 6 on the outside surface of an expandable tubular member.

Figure 11 is an illustration of the initial expansion of the expandable inflatable packer of Figure 10 using the expansion device of Figure 2.

Figure 12 is an illustration of the completion of the expansion of the expandable inflatable packer of Figure 11.

#### **DETAILED DESCRIPTION OF THE DRAWINGS**

Referring initially to Figure 1, a conventional device 100 for drilling a borehole 102 in a subterranean formation 104 is shown. The borehole 102 may be lined with casing 106 at the top portion of its length. An annulus 108 formed between the casing 106 and the formation 104 may be filled with a sealing material 110, such as, for example, cement. In an exemplary embodiment, the device 100 may be operated in a conventional manner to extend the length of the borehole 102 beyond the casing 106.

Referring now to Figure 2, a device 200 for coupling an expandable tubular member 202 to an existing tubular member, such as, for example, the existing casing 106, is shown. The device 200 includes a shoe 206 that defines a centrally positioned valveable passage 206a adapted to receive, for example, a ball, plug or other similar device for closing the passage. An end of the shoe 206b is coupled to a lower tubular end 208a of a tubular launcher assembly 208 that includes the lower tubular end, an upper tubular end 208b, and a tapered tubular transition member 208c. The lower tubular end 208a of the tubular launcher assembly 208 has a greater inside diameter than the inside diameter of the upper tubular end 208b. The tapered tubular transition member 208c connects the lower tubular end 208a and the upper tubular end 208b. An end of the upper tubular end 208b of the tubular launcher assembly 208 is coupled to an end of the expandable tubular member 202. One or more seals 210 are coupled to the outside surface of the other end of the expandable tubular member 202.

An expansion device 212 is centrally positioned within and mates with the tubular launcher assembly 208. The expansion device 212 defines a centrally positioned fluid pathway 212a, and includes a lower section 212b, a middle section 212c, and an upper section 212d. The lower section 212b of the expansion device 212 defines an inclined expansion surface 212ba that supports the

tubular launcher assembly 208 by mating with the tapered tubular transition member 208c of the tubular launcher assembly. An end of the upper section 212d of the expansion device 212 is coupled to an end of a tubular member 218 that defines a fluid pathway 218a. The fluid pathway 218a of the tubular member 218 is fluidically coupled to the fluid pathway 212a defined by the expansion device 212. One or more spaced apart cup seals 220 and 222 are coupled to the outside surface of the tubular member 218 for sealing against the interior surface of the expandable tubular member 202. In an exemplary embodiment, cup seal 222 is positioned near a top end of the expandable tubular member 202. A top fluid valve 224 is coupled to the tubular member 218 above the cup seal 222 and defines a fluid pathway 226 that is fluidically coupled to the fluid pathway 218a.

During operation of the device 200, as illustrated in Figure 2, the device 200 is initially lowered into the borehole 102. In an exemplary embodiment, during the lowering of the device 200 into the borehole 102, fluid 228 within the borehole 102 passes upwardly through the device 200 through the valveable passage 206a into the fluid pathway 212a and 218a and out of the device 200 through the fluid pathway 226 defined by the top fluid valve 224.

Referring now to Figure 3, in an exemplary embodiment, a hardenable fluidic sealing material 300, such as, for example, cement, is then pumped down the fluid pathway 218a and 212a and out through the valveable passage 206a into the borehole 102 with the top fluid valve 224 positioned closed. The hardenable fluidic sealing material 300 thereby fills an annular space 302 defined between the borehole 102 and the outside diameter of the expandable tubular member 102.

Referring now to Figure 4, a plug 402 is then injected into the fluid pathway 218a and 212a of the device 200 with a fluidic material 404. The plug 402 thereby fits into and closes the valveable passage 206a to further fluidic flow. Continued injection of the fluidic material 404 into the fluid pathway 218a and 212a of the device 200 then pressurizes a chamber 406 defined by the shoe 206, the bottom of the expansion device 212, and the walls of the launcher assembly 208 and the expandable tubular member 202. Continued pressurization of the chamber 406 then displaces the expansion device 212 in an upward direction 408 relative to the expandable tubular member 202 thereby causing radial expansion and plastic deformation of the launcher assembly 208 and the expandable tubular member.

Referring now to Figure 5, the radial expansion and plastic deformation of the expandable tubular member 202 is then completed and the expandable tubular member is coupled to the existing casing 106. The hardenable fluidic sealing material 300, such as, for example, cement fills the annulus 302 defined between the expandable tubular member 202 and the borehole 102. The device 200 is then withdrawn from the borehole 102 and a conventional device 100 for drilling the borehole may then be utilized to drill out the shoe 206 and extend the length of the borehole, if desired.

Referring now to Figure 6, an exemplary embodiment of an expandable inflatable packer 600 defines a centrally positioned internal passageway 602. A pressure source 604 is positioned within the centrally positioned internal passageway 602 and applies a radial contact pressure to the interior wall

606 of the centrally positioned internal passageway 602. The expandable inflatable packer 600 includes a tubular sleeve 608 that defines a sleeve chamber 610 filled with a fluid 612, such as, for example, glycol. An end of the tubular sleeve 608 is connected to a lower annular packer member 614 that defines a lower packer chamber 616. The sleeve chamber 610 is fluidically coupled to the lower packer chamber 616, in an exemplary embodiment, the lower packer chamber is filled with the fluid 612. The lower annular packer member 614 is coupled to a middle annular packer member 618 that defines a middle packer chamber 620. The middle packer chamber 620 is fluidically coupled to the lower packer chamber 616 by a first fluid flow control device 622, such as, for example, a valve. In an exemplary embodiment, the first fluid flow control device 622 opens to fluid flow upon reaching a minimum pressure differential across the first fluid flow control device. The middle annular packer member 618 is coupled to a top annular packer member 624 that defines a top packer chamber 626. The top packer chamber 626 is fluidically coupled to the middle packer chamber 620 by a second fluid flow control device 628, such as for example, a valve. In an exemplary embodiment, the second fluid flow control device 628 opens to fluid flow upon reaching a minimum pressure differential across the second orifice.

Referring now to Figure 7, the pressure source 604 has radially compressed a section 700 of the tubular sleeve 608 of the expandable inflatable packer 600 by applying a radial contact force to the interior wall 606 of the tubular sleeve, thereby radially compressing a section 702 of the sleeve chamber 610. The fluid 612 in the section 702 of the sleeve chamber 610 is thereby displaced 704 into the lower packer chamber 616, thereby expanding and inflating the lower annular packer member 614 until it contacts the borehole 102.

Referring now to Figure 8, further radial compression of a section 800 of the tubular sleeve 608 and the corresponding radial compression of section 802 of the sleeve chamber 610 increases the fluidic pressure in the lower packer chamber 616 to a level such that the minimum pressure differential across the first fluid flow control device 622 is reached, thereby allowing the fluid 612 to flow 804 into the middle packer chamber 620, thereby expanding and inflating the middle annular packer member 618 until it contacts the borehole 102.

Referring now to Figure 9, the pressure source 604 has completed the radial compression of the entire length of the sleeve 608 of the expandable inflatable packer 600, thereby compressing the entire length of the sleeve chamber 610 and increasing the fluidic pressure in the middle packer chamber 620 to a level such that the minimum pressure differential across the second orifice 628 is reached, thereby allowing the fluid 612 to flow 900 into the top packer chamber 626, thereby expanding and inflating the top annular packer member 624 until it contacts the borehole 102.

Referring now to Figure 10, an expandable tubular member 1000 for use in the device 200 includes the expandable inflatable packer 600 on the outside surface of the expandable tubular member. In an exemplary embodiment, the expandable tubular member 202 includes one or more of the expandable tubular members 1000.

Referring now to Figure 11, in an exemplary embodiment, during operation of the device 200, a section of the expandable tubular member 1000 is radially expanded and plastically deformed by the displacement of the expansion device 212 in the direction 408 relative to the expandable tubular member. The radial expansion and plastic deformation of a section of the expandable tubular member 1000 has compressed the section 700 of the sleeve 608 of the expandable inflatable packer 600 in a radial direction against the hardenable, sealing material 300 that fills the annulus 302, thereby radially compressing the section 702 of the sleeve chamber 610. The fluid 612 is thereby displaced 704 into the lower packer chamber 616, expanding and inflating the lower annular packer member 614 until it contacts the borehole 102.

Referring now to Figure 12, due to continued operation of the device 200, the expandable tubular member 1000 is radially and plastically deformed below the expandable inflatable packer 600 by the expansion device 212 being displaced in an upwardly direction 408 relative to the expandable tubular member. The radial expansion and plastic deformation of a section of the expandable tubular member 1000 has compressed the entire length of the sleeve 608 of the expandable inflatable packer 600 in a radial direction against the hardenable, sealing material 300 that fills the annulus 302, thereby radially compressing the entire length of the sleeve chamber 610. The compression of the sleeve chamber 610 has raised the fluid pressure to a level such that the minimum pressure differential across the first fluid flow control device 622 is reached, thereby allowing the fluid 612 to flow 800 into the middle packer chamber 620, thereby expanding and inflating the middle annular packer member 618 until it contacts the borehole 102. The compression of the sleeve chamber 610 has raised the fluid pressure to a level such that the minimum pressure differential across the second fluid flow control device 628 is also reached, thereby allowing the fluid 612 to flow 900 into the top packer chamber 626, thereby expanding and inflating the top annular packer member 624 until it contacts the borehole 102.

Although the expandable inflatable packer 600 has been described operating with the device 200, the expandable inflatable packer could be used with any type of expansion device.

Referring now to Figure 13, an exemplary embodiment of an expandable tubular member 1300 defines a first tubular section 1302 having an end of the first tubular section coupled to an intermediate tubular section 1304 having a smaller inside diameter than the first tubular section by a first tapered tubular transition member 1306. One or more expandable inflatable packers 600 are coupled to the outside surface of the intermediate tubular section 1304. The intermediate tubular section 1304 is coupled to a second tubular section 1308 having a greater inside diameter than the intermediate tubular section by a second tapered tubular transition member 1310.

In an exemplary embodiment, the expandable tubular member 202 includes one or more of the expandable tubular members 1000 and 1300.

Referring now to Figure 14, an expansion cone 1400 defines an upper cone 1402, a middle cone 1404, and a lower tubular end 1406. The upper cone 1402 has a leading surface 1408 and an

outer inclined surface 1410 that defines an angle  $\alpha_1$ . The middle cone 1404 has an outer inclined surface 1412 that defines an angle  $\alpha_2$ . In an exemplary embodiment, the angle  $\alpha_1$  is greater than the angle  $\alpha_2$ . The outer inclined surfaces 1410 and 1412 together form the expansion surfaces 1414 that upon displacement of the expansion cone 1400 relative to the expandable tubular member 202, radially expand and plastically deform the expandable tubular member.

Referring now to Figure 15, an exemplary embodiment of an expansion cone 1500 with an outside expansion surface 1502 defining a parabolic equation, is shown. The expansion cone 1500 has an upper expansion section 1504 and a lower tubular end 1506. The upper expansion section 1504 has a leading surface 1508 and the outside expansion surface 1508 defined by a parabolic equation.

In an exemplary embodiment, the expandable tubular member 202 includes one or more of the expandable tubular members 1000 and 1300. In an exemplary embodiment, the device 200 includes one or more of the expandable tubular members 1000 and 1300, and one or more of the expansion cones 1400 and 1500.

A packer has been described that includes a plurality of tubular members that each define a chamber, wherein the chambers are fluidically coupled together by one or more fluid flow control devices. The packer is coupled to the outside surface of an expandable tubular member; wherein the expandable tubular member comprises: a first tubular section comprising a first outer diameter; an intermediate tubular section comprising an intermediate outer diameter coupled to the first tubular section; and a second tubular section comprising a second outer diameter coupled to the intermediate tubular section. The first and second outer diameters are greater than the intermediate outer diameter; and the packer is coupled to the outside surface of the intermediate tubular section.

A packer has been described that includes a plurality of tubular members that each define a chamber; wherein the chambers are fluidically coupled together; and

a pressure source positioned within one or more of the tubular members for applying a contact pressure to one or more portions of one or more of the tubular members. The pressure source is radial expansion and plastic deformation of a tubular member by an expansion device. The chambers are fluidically coupled together by one or more fluid flow control devices. The packer is coupled to the outside surface of an expandable tubular member; wherein the expandable tubular member includes a first tubular section with a first outer diameter; an intermediate tubular section with an intermediate outer diameter coupled to the first tubular section; and a second tubular section with a second outer diameter coupled to the intermediate tubular section; wherein the first and second outer diameters are greater than the intermediate outer diameter. The packer is coupled to the outside surface of the intermediate tubular section.

A method of forming a seal in an annulus in a borehole located in a subterranean formation has been described that includes installing a tubular liner and an expansion device in the borehole; injecting fluidic material into the borehole; pressurizing a portion of an interior region of the tubular liner; and radially expanding at least a portion of the liner in the borehole by extruding at least a



portion of the liner off of the expansion device. The outside surface of the liner comprises a plurality of tubular members that each define a chamber; wherein the chambers are fluidically coupled together; and wherein the chambers are fluidically coupled together by one or more fluid flow control devices. The liner includes a first tubular section with a first outer diameter; an intermediate tubular section with an intermediate outer diameter coupled to the first tubular section; and a second tubular section with a second outer diameter coupled to the intermediate tubular section. The first and second outer diameters are greater than the intermediate outer diameter; and the plurality of tubular members are coupled to the outside surface of the intermediate tubular section.

A method of forming a seal in an annulus in a borehole located in a subterranean formation has been described that includes means for installing a tubular liner and an expansion device in the borehole; means for injecting fluidic material into the borehole; means for pressurizing a portion of an interior region of the tubular liner; and means for radially expanding at least a portion of the liner in the borehole by extruding at least a portion of the liner off of the expansion device. The outside surface of the liner comprises a plurality of tubular members that each define a chamber; wherein the chambers are fluidically coupled together; and wherein the chambers are fluidically coupled together by one or more fluid flow control devices. The liner includes a first tubular section with a first outer diameter; an intermediate tubular section with an intermediate outer diameter coupled to the first tubular section; and a second tubular section with a second outer diameter coupled to the intermediate tubular section. The first and second outer diameters are greater than the intermediate outer diameter; and the plurality of tubular members are coupled to the outside surface of the intermediate tubular section.

Although illustrative embodiments of the invention have been shown and described, a wide range of modification, changes and substitution is contemplated in the foregoing disclosure. In some instances, some features of the present invention may be employed without a corresponding use of the other features, and some steps of the present invention may be executed without a corresponding execution of other steps. Accordingly, all such modifications, changes and substitutions are intended to be included within the scope of this invention as defined in the following claims, and it is appropriate that the claims be construed broadly and in a manner consistent with the scope of the invention. In the claims, means-plus-function clauses are intended to cover the structures described herein as performing the recited function and not only structural equivalents, but also equivalent structures.

**CLAIMS**

What is claimed is:

1. A packer, comprising:  
a plurality of tubular members that each define a chamber, wherein the chambers are fluidically coupled together.
2. The packer of claim 1, wherein the chambers are fluidically coupled together by one or more fluid flow control devices.
3. The packer of claim 2, wherein the fluid flow control devices comprise one or more valves.
4. The packer of claim 2, wherein the fluid flow control devices comprise one or more orifices.
5. The packer of claim 1, wherein the packer is coupled to the outside surface of an expandable tubular member.
6. The packer of claim 5, wherein the expandable tubular member comprises:  
a first tubular section comprising a first outer diameter;  
an intermediate tubular section comprising an intermediate outer diameter coupled to the first tubular section; and  
a second tubular section comprising a second outer diameter coupled to the intermediate tubular section;  
and  
wherein the first and second outer diameters are greater than the intermediate outer diameter.
7. The packer of claim 6, wherein the packer is coupled to the outside surface of the intermediate tubular section.
8. A packer, comprising:  
a plurality of tubular members that each define a chamber, wherein the chambers are fluidically coupled together;  
wherein the chambers are fluidically coupled together by one or more fluid flow control devices;  
wherein the fluid flow control devices comprise one or more valves;  
wherein the packer is coupled to the outside surface of an expandable tubular member;  
wherein the expandable tubular member comprises:

a first tubular section comprising a first outer diameter;  
an intermediate tubular section comprising an intermediate outer diameter coupled to  
the first tubular section; and  
a second tubular section comprising a second outer diameter coupled to the  
intermediate tubular section;  
wherein the first and second outer diameters are greater than the intermediate outer diameter;  
and  
wherein the packer is coupled to the outside surface of the intermediate tubular section.

9. A packer, comprising:  
a plurality of tubular members that each define a chamber, wherein the chambers are fluidically  
coupled together; and  
a pressure source positioned within one or more of the tubular members for applying a radial  
contact pressure to one or more portions of one or more of the tubular members.
10. The packer of claim 9, wherein the pressure source is adapted to radially expand and  
plastically deform the one or more portions of one or more of the tubular members.
11. The packer of claim 10, wherein the pressure source comprises an expansion device.
12. The packer of claim 9, wherein the chambers are fluidically coupled together by one or more  
fluid flow control devices.
13. The packer of claim 12, wherein the fluid flow control devices comprise one or more valves.
14. The packer of claim 12, wherein the fluid flow control devices comprise one or more orifices.
15. The packer of claim 9, wherein the packer is coupled to the outside surface of an expandable  
tubular member.
16. The packer of claim 15, wherein the expandable tubular member comprises:  
a first tubular section comprising a first outer diameter;  
an intermediate tubular section comprising an intermediate outer diameter coupled to  
the first tubular section; and  
a second tubular section comprising a second outer diameter coupled to the  
intermediate tubular section;  
and

- wherein the first and second outer diameters are greater than the intermediate outer diameter.
17. The packer of claim 16, wherein the packer is coupled to the outside surface of the intermediate tubular section.
18. A packer, comprising:  
a plurality of tubular members that each define a chamber, wherein the chambers are fluidically coupled together; and  
a pressure source positioned within one or more of the tubular members for applying a contact pressure to one or more portions of one or more of the tubular members;  
wherein the pressure source is adapted to radially expand and plastically deform the one or more portions of one or more of the tubular members;  
wherein the pressure source comprises an expansion device;  
wherein the chambers are fluidically coupled together by one or more fluid flow control devices;  
wherein the fluid flow control devices comprise one or more valves;  
wherein the packer is coupled to the outside surface of an expandable tubular member;  
wherein the expandable tubular member comprises:  
a first tubular section comprising a first outer diameter;  
an intermediate tubular section comprising an intermediate outer diameter coupled to the first tubular section; and  
a second tubular section comprising a second outer diameter coupled to the intermediate tubular section;  
wherein the first and second outer diameters are greater than the intermediate outer diameter;  
and  
wherein the packer is coupled to the outside surface of the intermediate tubular section.
19. A method of forming a seal in an annulus in a borehole located in a subterranean formation, comprising:  
installing a tubular liner and an expansion device in the borehole;  
injecting fluidic material into the borehole;  
pressurizing a portion of an interior region of the tubular liner; and  
radially expanding at least a portion of the liner in the borehole by extruding at least a portion of the liner off of the expansion device;  
wherein a plurality of tubular members that each define a chamber are coupled to the outside surface of the liner; and  
wherein the chambers are fluidically coupled together.

20. The method of claim 19, wherein the chambers are fluidically coupled together by one or more fluid flow control devices.
21. The method of claim 20, wherein the fluid flow control devices comprise one or more valves.
22. The method of claim 20, wherein the fluid flow control devices comprise one or more orifices.
23. The method of claim 19, wherein the liner comprises:
  - a first tubular section comprising a first outer diameter;
  - an intermediate tubular section comprising an intermediate outer diameter coupled to the first tubular section; and
  - a second tubular section comprising a second outer diameter coupled to the intermediate tubular section;and  
wherein the first and second outer diameters are greater than the intermediate outer diameter.
24. The method of claim 23, wherein the plurality of tubular members are coupled to the outside surface of the intermediate tubular section.
25. A method of forming a seal in an annulus in a borehole located in a subterranean formation, comprising:
  - installing a tubular liner and an expansion device in the borehole;
  - injecting fluidic material into the borehole;
  - pressurizing a portion of an interior region of the tubular liner; and
  - radially expanding at least a portion of the liner in the borehole by extruding at least a portion of the liner off of the expansion device;wherein a plurality of tubular members that each define a chamber are coupled to the outside surface of the liner;  
wherein the chambers are fluidically coupled together;  
wherein the chambers are fluidically coupled together by one or more fluid flow control devices;  
wherein the fluid flow control devices comprise one or more valves;  
wherein the liner comprises:
  - a first tubular section comprising a first outer diameter;
  - an intermediate tubular section comprising an intermediate outer diameter coupled to the first tubular section; and

- a second tubular section comprising a second outer diameter coupled to the intermediate tubular section;  
wherein the first and second outer diameters are greater than the intermediate outer diameter; and  
wherein the plurality of tubular members are coupled to the outside surface of the intermediate tubular section.
26. A system for forming a seal in an annulus in a borehole located in a subterranean formation comprising:  
means for installing a tubular liner and an expansion device in the borehole;  
means for injecting fluidic material into the borehole;  
means for pressurizing a portion of an interior region of the tubular liner; and  
means for radially expanding at least a portion of the liner in the borehole by extruding at least a portion of the liner off of the expansion device;  
wherein the outside surface of the liner comprises a plurality of tubular members that each define a chamber; and  
wherein the chambers are fluidicly coupled together.
27. The system of claim 26, wherein the chambers are fluidicly coupled together by one or more fluid flow control devices.
28. The system of claim 26, wherein the fluid flow control devices comprise one or more valves.
29. The system of claim 26, wherein the fluid flow control devices comprise one or more orifices.
30. The system of claim 26, wherein the liner comprises:  
a first tubular section comprising a first outer diameter;  
an intermediate tubular section comprising an intermediate outer diameter coupled to the first tubular section; and  
a second tubular section comprising a second outer diameter coupled to the intermediate tubular section;  
and  
wherein the first and second outer diameters are greater than the intermediate outer diameter.
31. The system of claim 30, wherein the plurality of tubular members are coupled to the outside surface of the intermediate tubular section.

32. A system of forming a seal in an annulus in a borehole located in a subterranean formation, comprising:
- means for installing a tubular liner and an expansion device in the borehole;
  - means for injecting fluidic material into the borehole;
  - means for pressurizing a portion of an interior region of the tubular liner; and
  - means for radially expanding at least a portion of the liner in the borehole by extruding at least a portion of the liner off of the expansion device;
- wherein the outside surface of the liner comprises a plurality of tubular members that each define a chamber;
- wherein the chambers are fluidicly coupled together;
- wherein the chambers are fluidicly coupled together by one or more fluid flow control devices;
- wherein the fluid flow control devices comprise one or more valves;
- wherein the liner comprises:
- a first tubular section comprising a first outer diameter;
  - an intermediate tubular section comprising an intermediate outer diameter coupled to the first tubular section; and
  - a second tubular section comprising a second outer diameter coupled to the intermediate tubular section;
- wherein the first and second outer diameters are greater than the intermediate outer diameter; and
- wherein the plurality of tubular members are coupled to the outside surface of the intermediate tubular section.

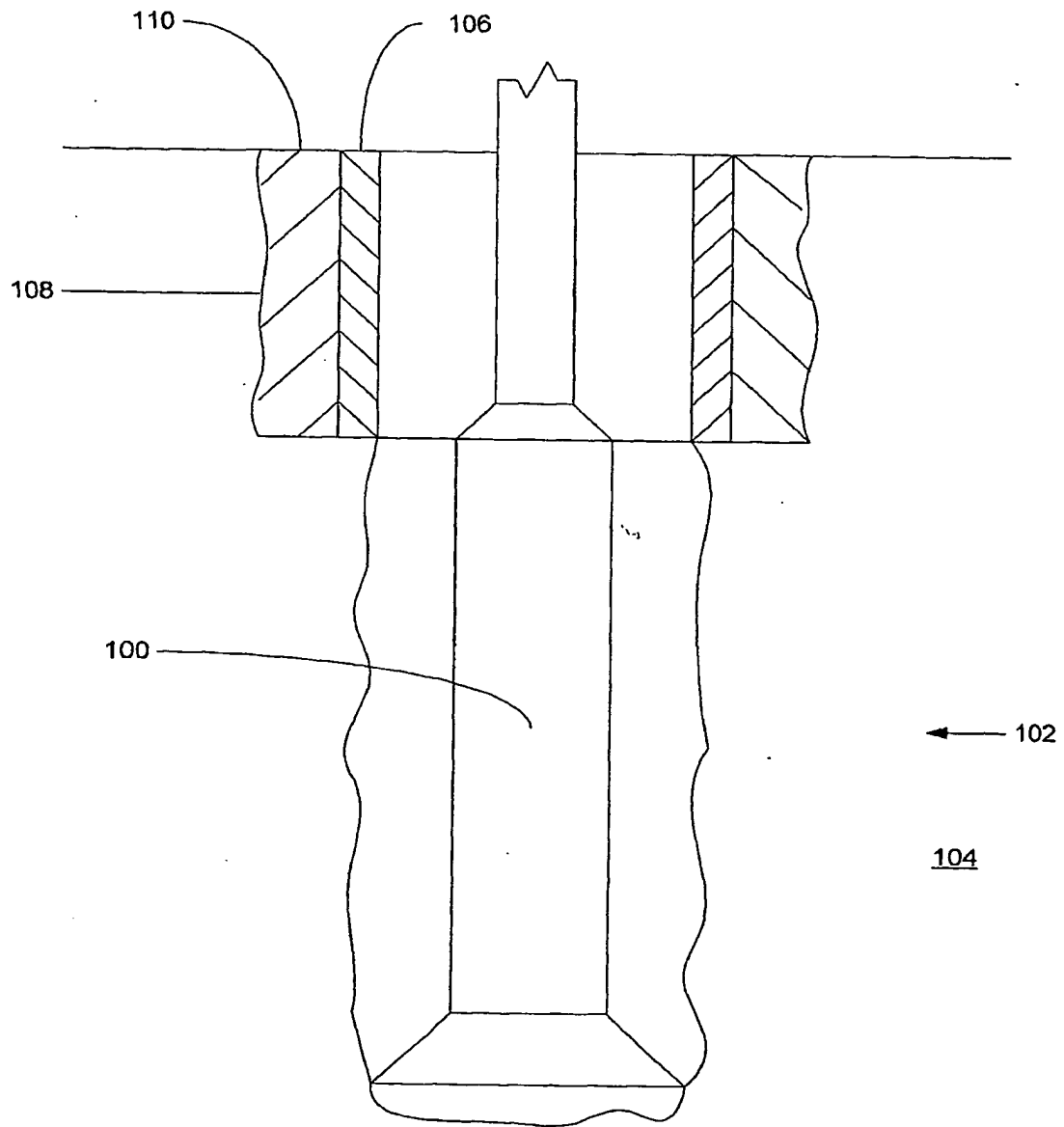


FIGURE 1



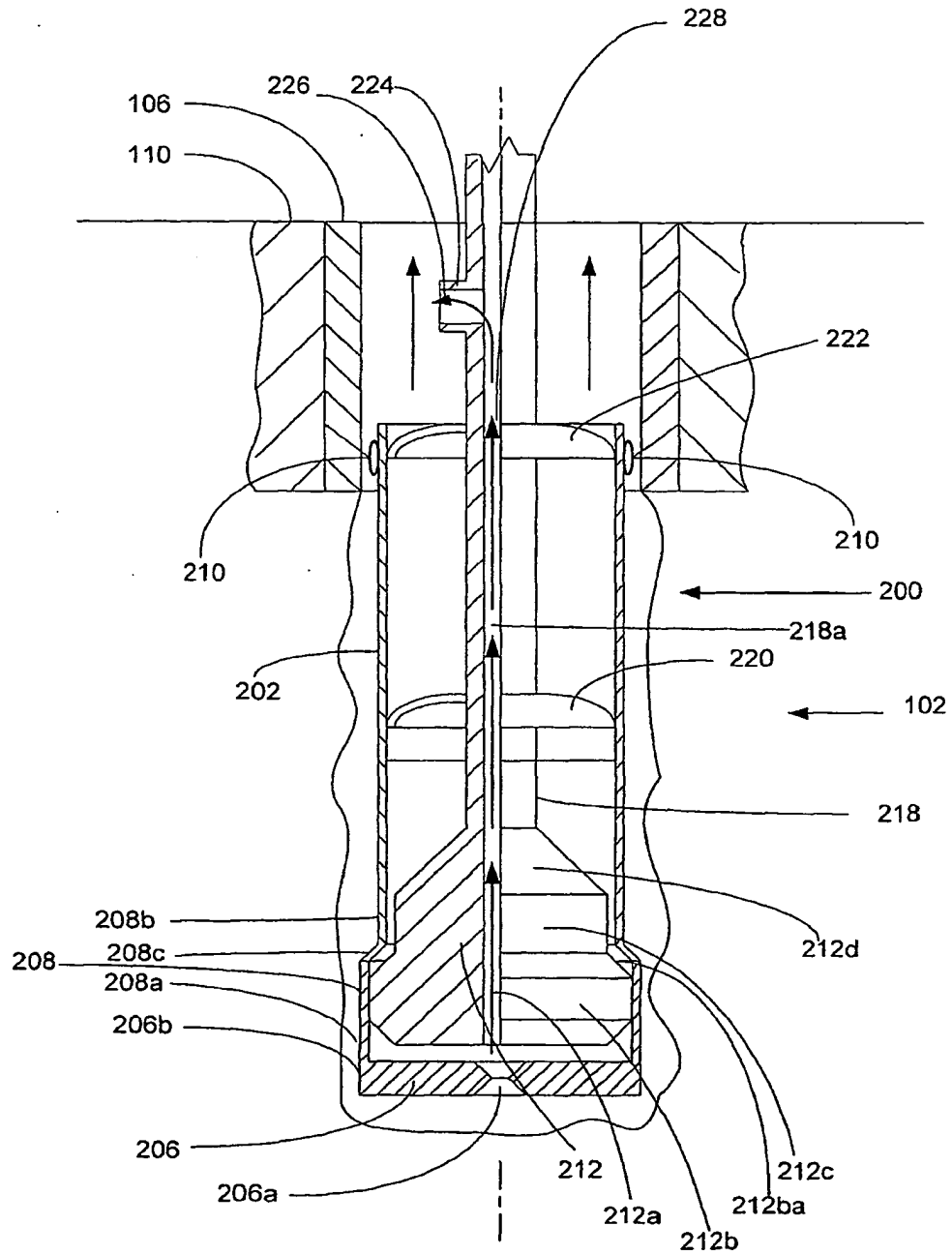


FIGURE 2

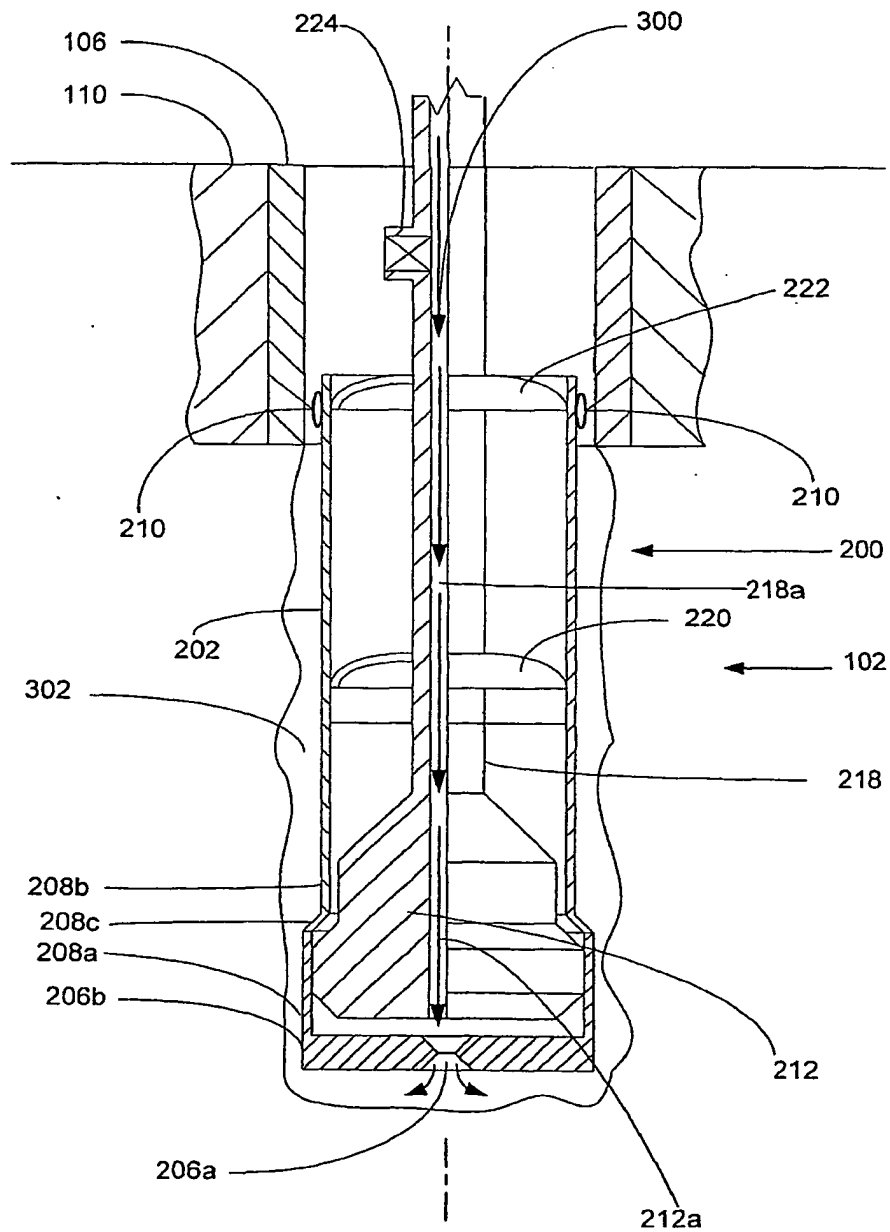


FIGURE 3

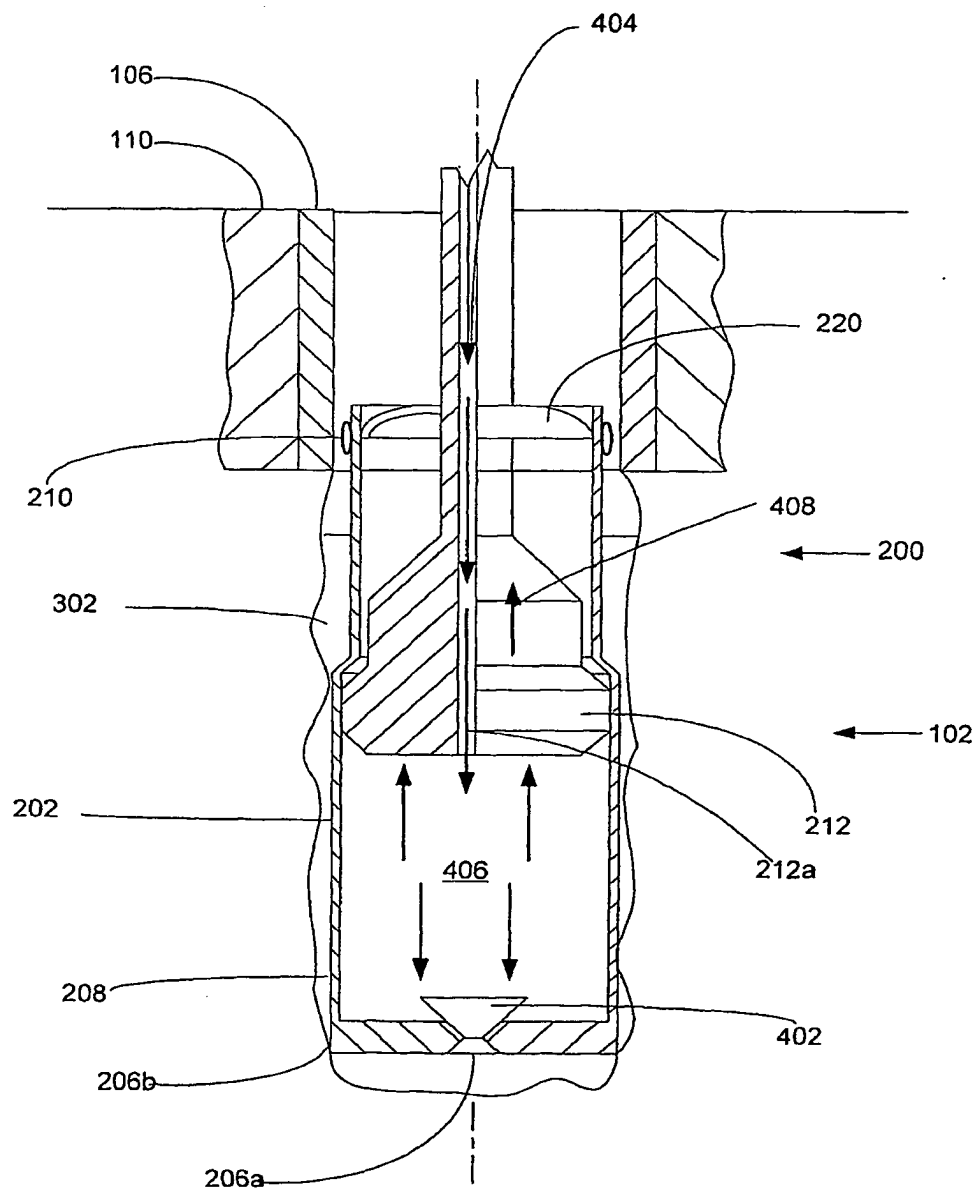


FIGURE 4

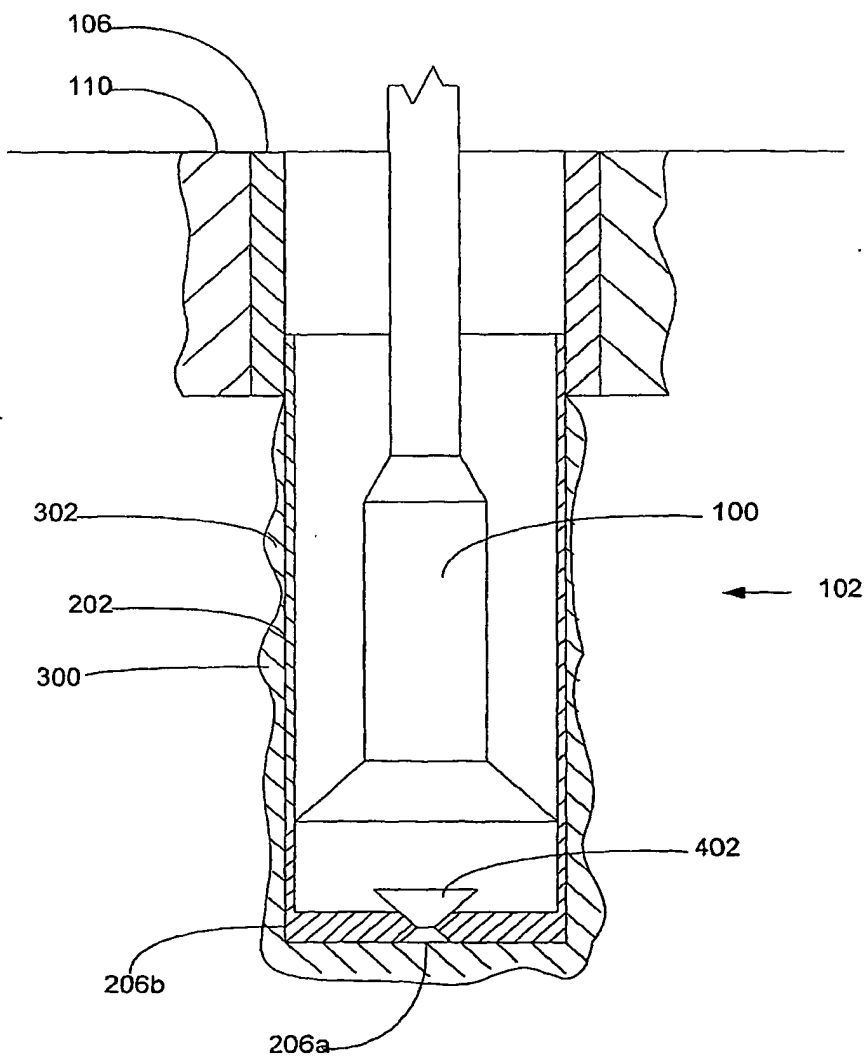


FIGURE 5

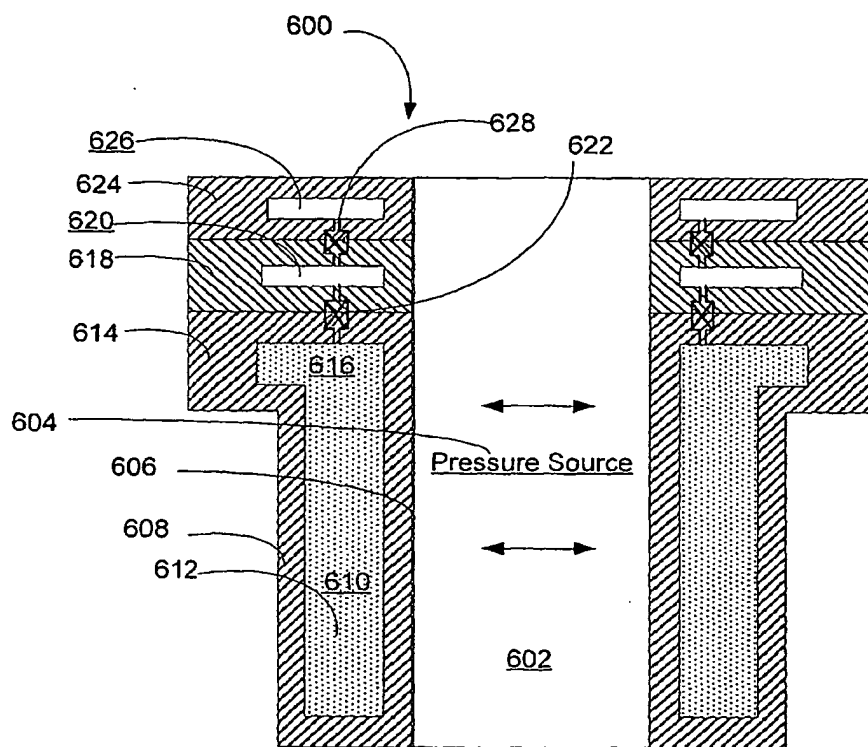


FIGURE 6

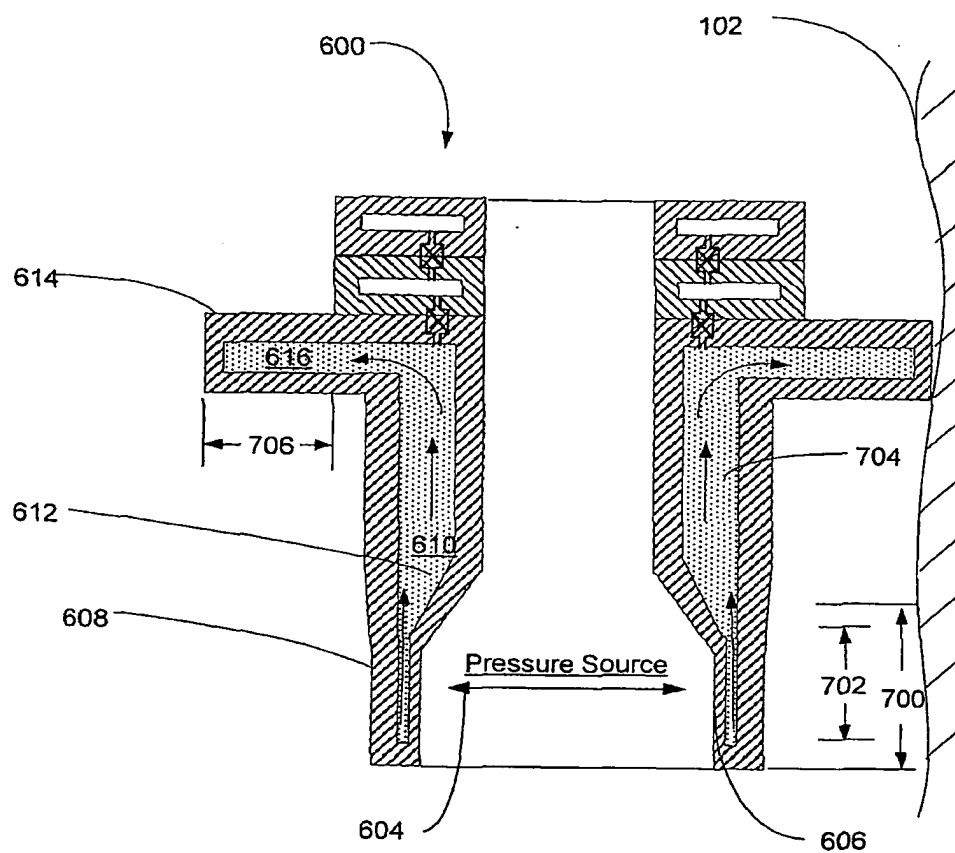


FIGURE 7

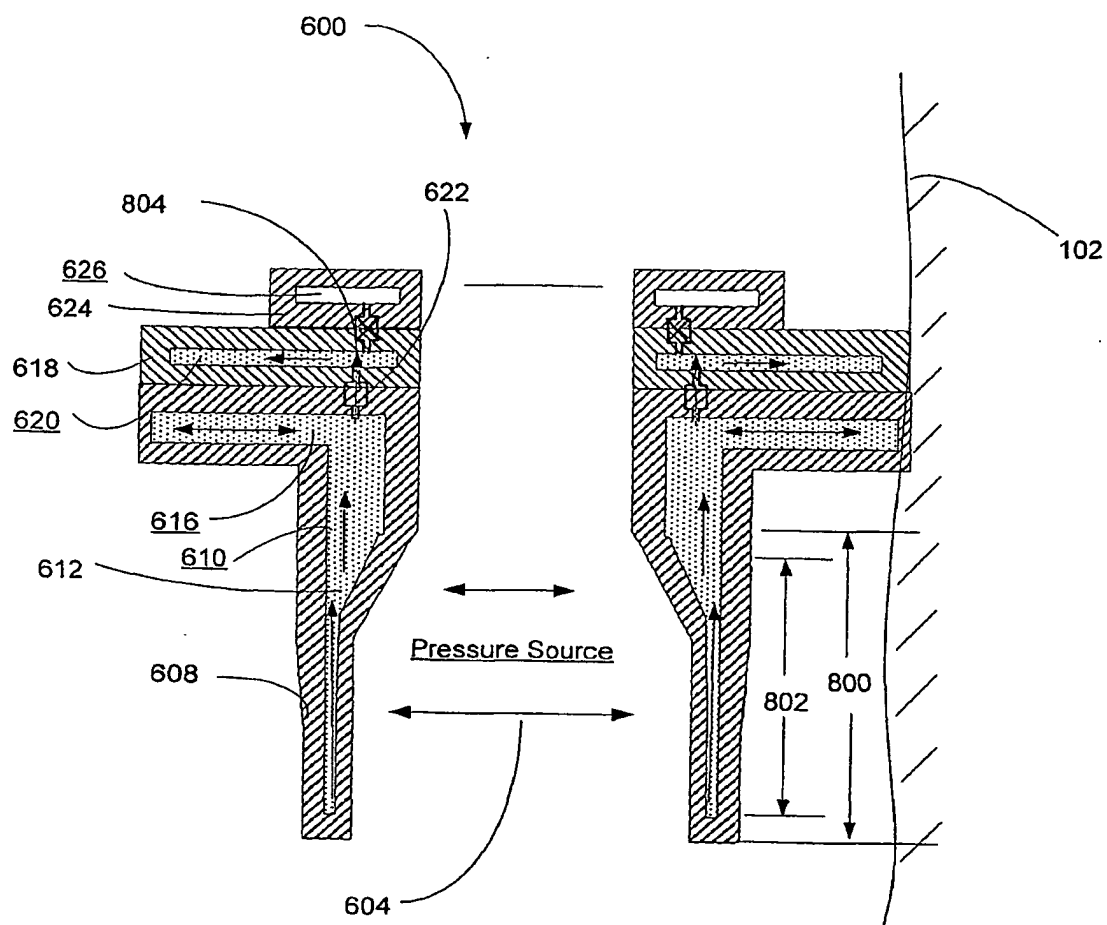


FIGURE 8

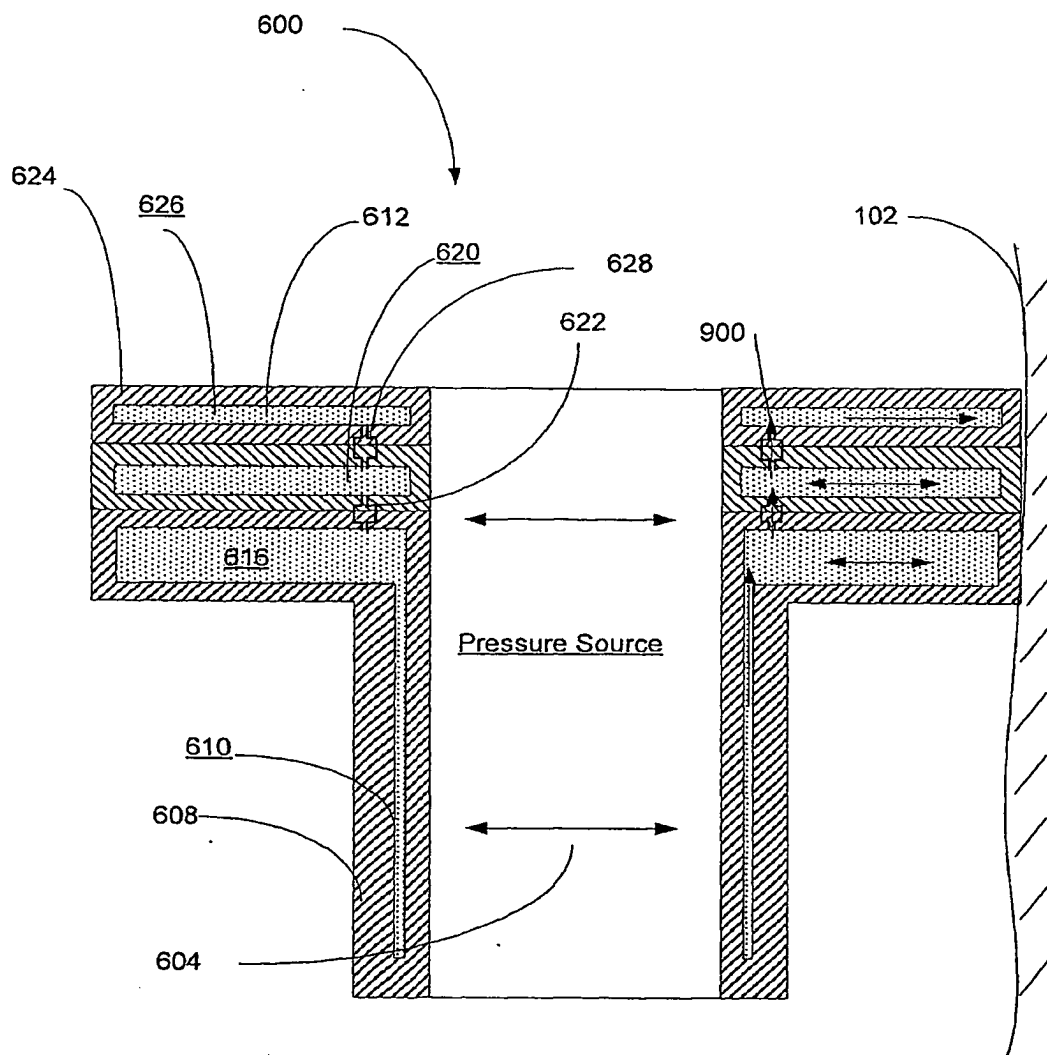


FIGURE 9



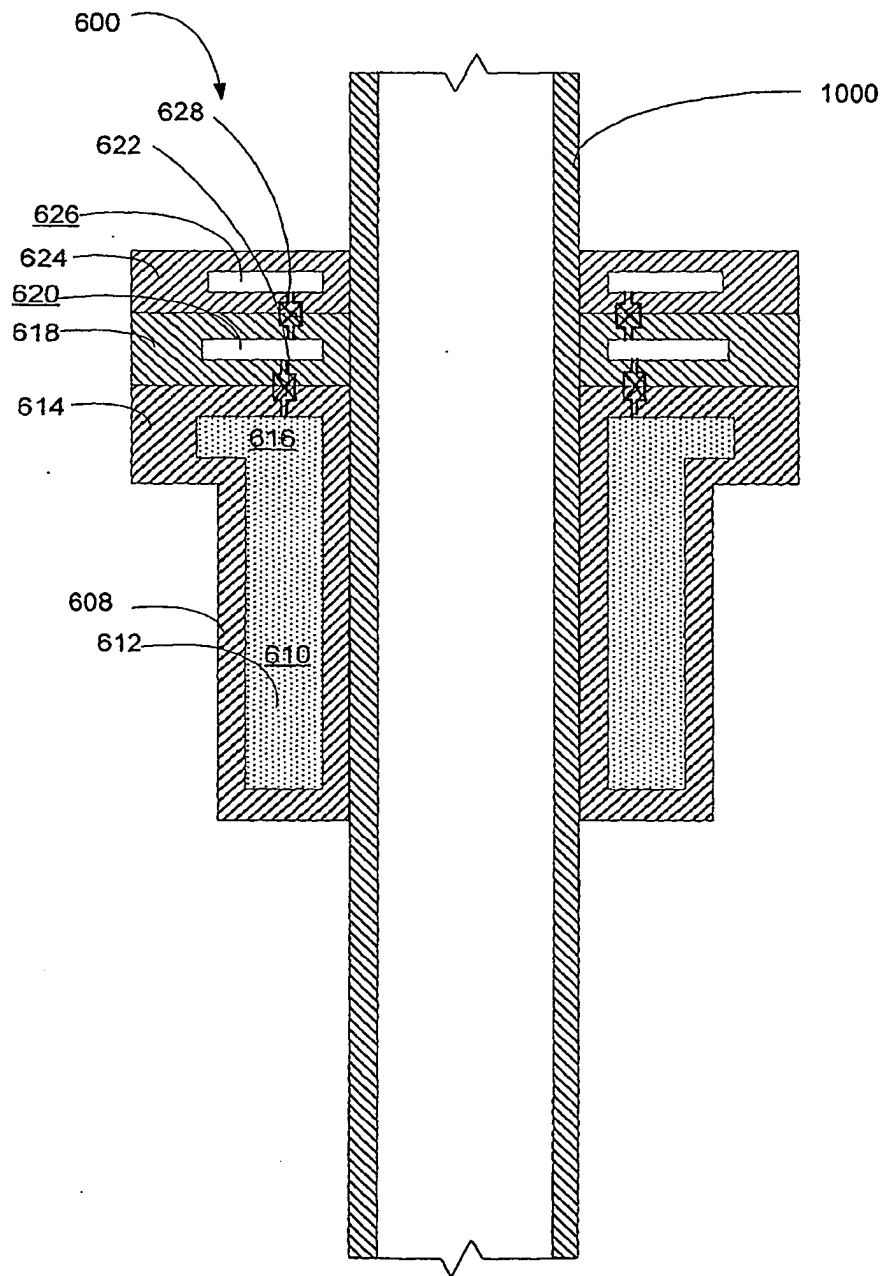


FIGURE 10

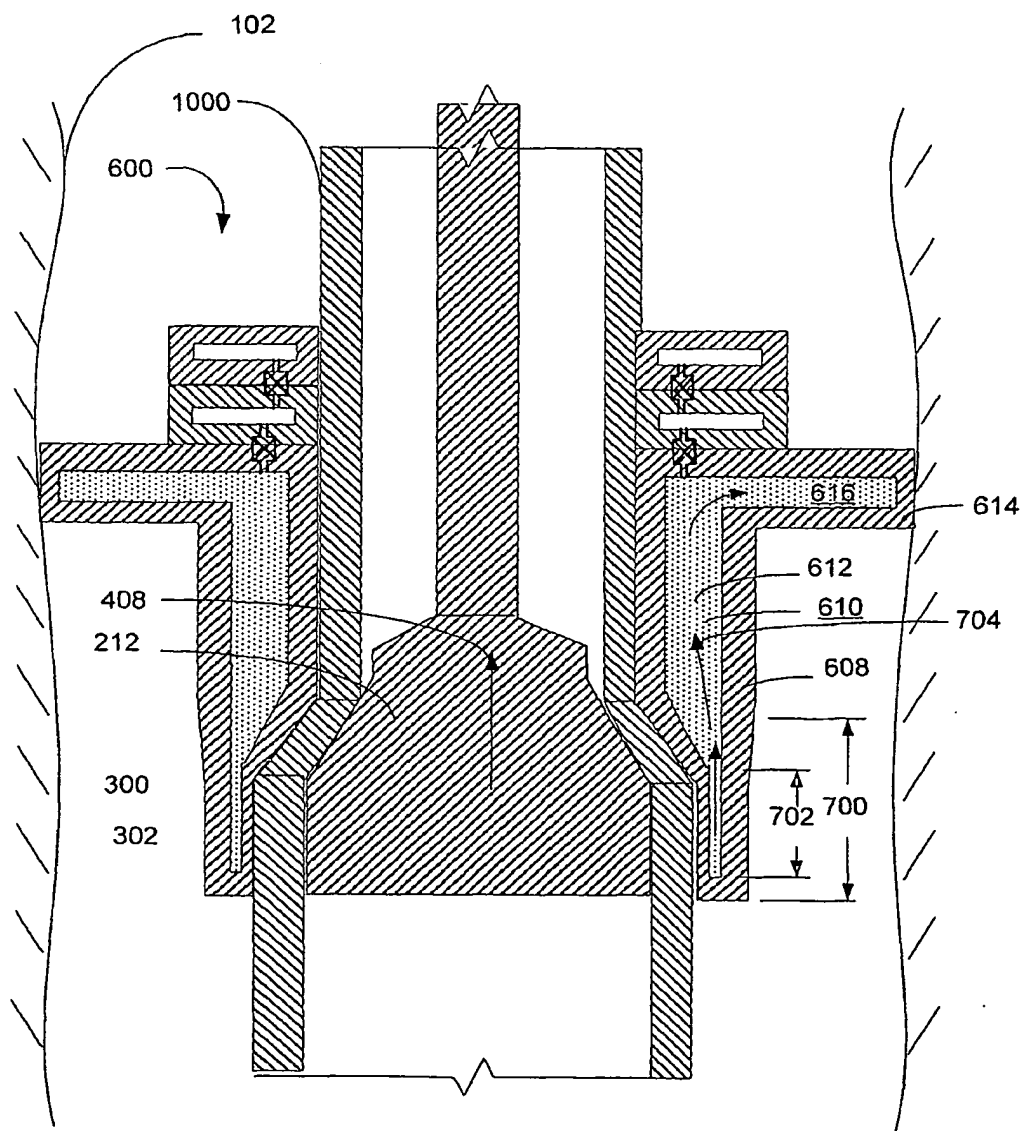


FIGURE 11

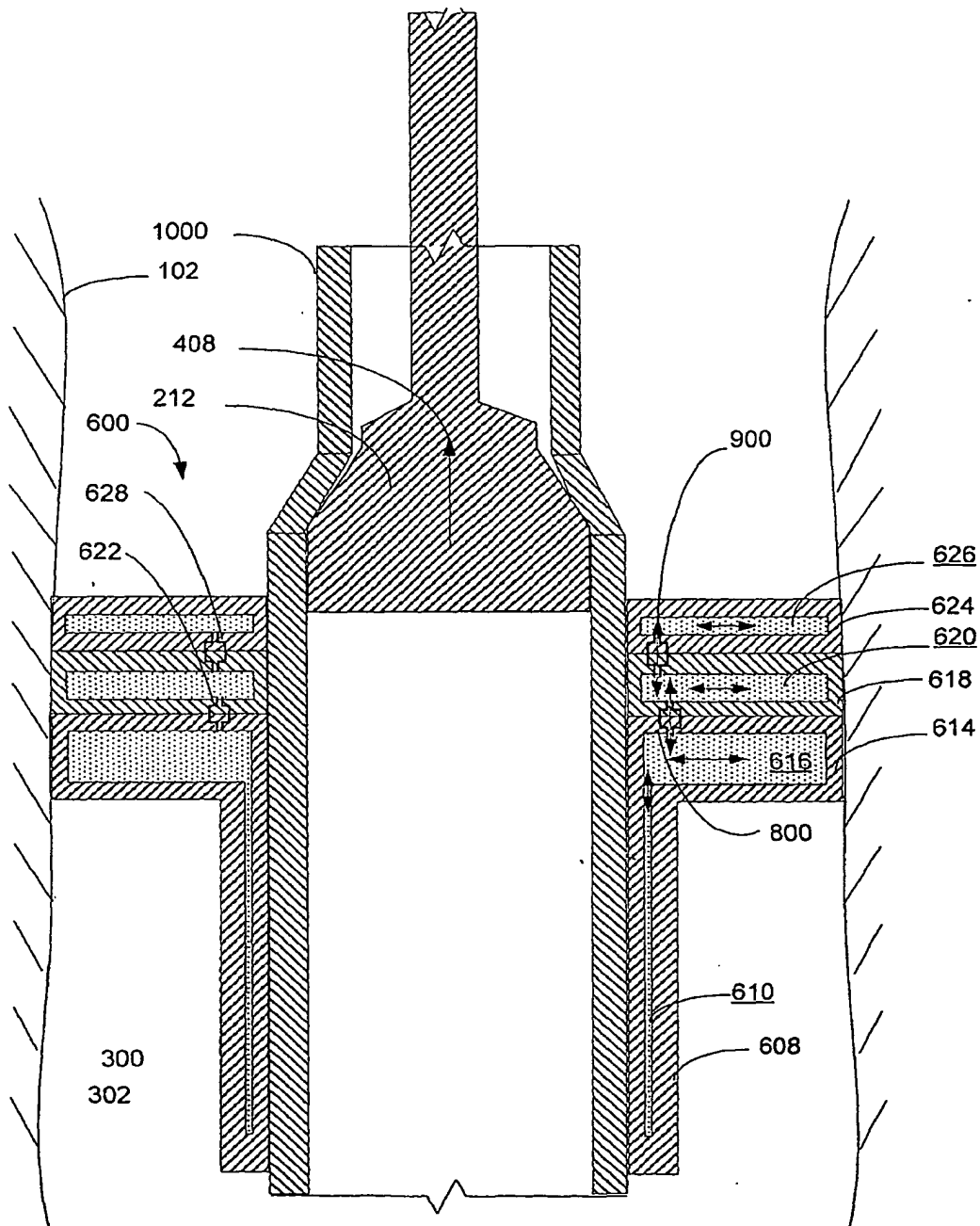


FIGURE 12

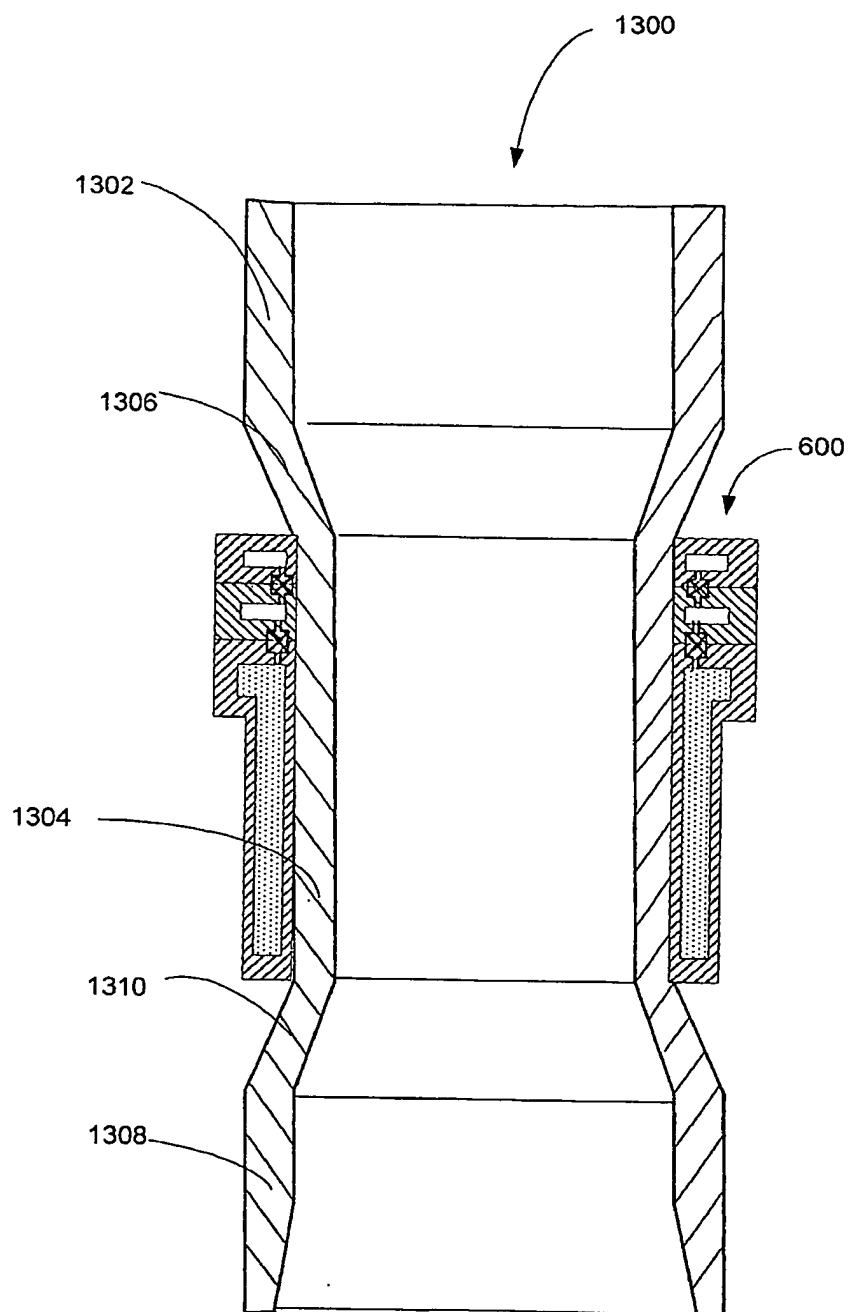


FIGURE 13

